SCIENCE & EDUCATION
Impact
Benefits from USDA/Land-Grant Partnership

Building Blocks

Genome mapping, biotech studies stepping stones to progress.

A better understanding of genes and how they work has led to tremendous advances in medicine and agriculture. Gene maps help guide biomedical researchers in the quest for new disease cures. They're also vital for traditional breeding programs that make crops more productive and resistant to diseases and pests. Genetic probes, the basic tools of biotechnology, help identify ways to fight diseases and promote health.

Genes and DNA, nature's biological building blocks, are at the heart of the biotech controversy. If you can take a building block from one living thing and put it into another, should you? Land-Grant and USDA research addresses these issues as well as the opportunities for transferring and manipulating genes.

Work goes on and minute advances add up to big progress.

Payoff

- **Unraveling the maize maze.** Researchers at **Arizona** are mapping the 50,000 genes in corn, the nation's most important crop. They're about half way there. As they work, they're sharing information with public and private researchers to develop improved traits in corn and genetically similar crops such as wheat, barley, rice and oats. **Missouri** researchers are doing related work that involves the study and understanding of gene location and gene function.

- **Pharmers?** Researchers at **Arkansas** engineered plants to produce two human proteins that may be involved in the regulation of cancer metastasis. Large-scale, low-cost production of these two cancer-related proteins in plants may facilitate their practical use in early cancer diagnosis or treatment. Farmers may become pharmaceutical producers.

- **Cocoa clone.** More than 40 percent of the world's cocoa crop is lost to diseases and insects. **Penn State** scientists developed a method to clone individual cells of highly productive cocoa plants and grow them into full-sized plants. Because it's possible to clone as many as 4,000 new cocoa plants from just one flower, farmers in developing countries will have access to ample quantities of high-quality plants.

RESEARCH, EXTENSION AND EDUCATION AT WORK

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- **From fruit to nuts.** Scientists at **Oregon State** improved biotechnology techniques that can speed the production of nursery stock for hazelnuts and pears and shorten the time it takes to make new varieties available. The more efficient crops should be worth on average $500 more per acre.

- **Starlink stink.** When biotech corn not approved for human consumption was found mixed with non-biotech corn, **Iowa State** Extension worked with farmers and grain elevators to help figure out what to do with it. Scientists there are developing tests to determine the genetic content of seed and grain to help elevators keep transgenic crops separate and are developing standardized tests to detect seeds containing inserted genes.

- **Learning lessons. Arkansas, Delaware** and **North Carolina A&T** programs give students a background in biotechnology and its applications and challenge them to think critically about how biotechnology is used, misused, portrayed and perceived. **Virginia Tech's** workshops and **Purdue's** Internet course are aimed at high school science and agriculture teachers.

- **Healthy fat.** Food scientists in **Georgia** used biotechnology to attach specific fatty acids with nutritional and functional properties to the glycerol part of conventional fats and oils. When fed to mice, those designed fats lowered blood cholesterol by half and boosted the immune system by increasing the T-cells 19 percent. The work may be important for treating people with AIDS who have low T-cell counts and individuals with elevated cholesterol levels.

- **Ready or not?** Research from **Nebraska** showed Roundup Ready soybeans that contain a gene that prevents damage from a glyphosate-based herbicide yielded 5 to 10 percent less than conventional varieties. Findings help farmers weigh their options.

- **Beetle baffler.** Researchers with **New Mexico State** and **Michigan State** have inserted several versions of synthetic *Bacillus thuringiensis* (Bt) and other pesticidal genes into potatoes to produce proteins toxic to Colorado potato beetles but harmless to humans and animals. The combination of genes makes it difficult for the pest to become resistant to pest resistance traits. In tests, beetles don't even land on the transgenic plants.

- **Health help.** Researchers at **Virginia Tech** have bioengineered pigs that produce human blood-clotting agents in their milk. The American Red Cross estimates that the therapeutic value for each of these blood proteins is in the millions of dollars. Availability of these products will save lives and improve the quality of life for those in need of the therapeutic proteins.

- **Chicken genes.** Research at **Tuskegee** has added 15 genes to the genome map for the chicken, which only includes 200 genes so far. The information will help researchers who are developing chickens with improved production and product quality characteristics.

- **Bean gene map.** Geneticists from **Nebraska** developed one of three soybean populations used to construct the first comprehensive genetic map for all 20 soybean chromosomes. It includes more than 1,800 genetic markers — specialized DNA segments that serve as landmarks on the genetic map. In related research, **Illinois** and **Iowa State** researchers are using markers to develop improved soybeans.

- **Bull clone. Texas A&M** researchers cloned a bull calf from cells frozen for 15 years. The resulting calf is believed to be the first animal specifically cloned for disease resistance. The cells were from a bull that was naturally resistant to brucellosis, tuberculosis and salmonellosis — infectious diseases that can be transmitted among cattle or to humans. Breeding resistance into cattle could reduce pathogens in meat and milk and benefit ranchers who cannot afford to vaccinate or test their herds for these diseases.

Cooperative State Research, Education, and Extension Service
United States Department of Agriculture

Cooperative State Research, Education, and Extension Service in cooperation with the Extension Committee on Organization and Policy, the Experiment Station Committee on Organization and Policy, the Academic Programs Committee on Organization and Policy, the International Programs Committee on Organization and Policy, and the Louisiana State University Agricultural Center.

April 2001